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Critical Analysis of the Application of the Safe Working Cycle (SWC): Interview Findings from Hong Kong

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Abstract

Purpose – This paper aims to investigate the effectiveness of the Safe Working Cycle (SWC) in improving existing site safety performance of construction projects in Hong Kong, and to identify the perceived benefits, potential difficulties and insightful recommendations of implementing the SWC in the future.

Design/methodology/approach – The professional views on the effectiveness of implementing the SWC, the benefits and difficulties of the SWC, together with the effective recommendations for future execution of the SWC, were gleaned by ten in-depth interviews involving the representatives of senior professional staff members from major construction companies and related government works departments.

Findings – Responses from in-depth interviews indicated that the SWC is generally effective in improving site safety performance and preventing the occurrence of construction accidents. The implementation of the SWC is also found useful in facilitating safety-related communications, enhancing safety awareness of frontline workers and identifying potential hazards. However, the industrial practitioners encountered some difficulties associated with the SWC, including limited space on worksites, irregular working schedules for the different trades working on-site, a lack of motivation for participation by workers, and an over-tight project schedule that causes time pressure to complete work resulting in a lack of priority.

Practical implications – The recommended measures include the establishment of a reward scheme, engagement of professional aerobic trainers, design of site-specific SWC, mandatory enforcement of the SWC through legislation, regular review of the SWC effectiveness, increased financial support from client organisations, and creation of a more realistic project schedule.

Originality/value – This study has instigated a wider debate on the underlying benefits and potential difficulties of the SWC for reference by the construction industry at large. Although the SWC is being currently executed in those new-build construction projects only, it may likewise be applied to other projects within the wide spectrum of facilities management sector and large-scale building repair / maintenance services in both Hong Kong and overseas. Therefore, the contribution from this paper could be extended to the discipline of facilities management as well.

Keywords: Hong Kong, Safety measures, Construction industry, Safe working cycle, Safety habits, Site safety performance

1. Introduction

High-rise buildings in Hong Kong, such as the 118-storey International Commerce Centre and the 88-storey Two International Finance Centre, stand more than 400 metres in height. While these structures are very high, the accident rate in the Hong Kong construction industry is equally very high compared with that of other developed countries or regions (Choi et al., 2012). The primary causes of construction accidents could be classified into management problems, poor working conditions and the carelessness of workers (Tang et al., 2003). In this context, management must formulate effective safety initiatives to substantially improve site safety performance, increase safety in operations and create a safe working environment for workers (Anton, 1989; Abdelharmid and Everett, 2000; Rowlinson, 2003).

Different safety initiatives have been introduced since the 1990s to minimise construction accidents, such as the Safety Management System (SMS), the Performance Assessment Scoring System (PASS), the Pay-for-Safety Scheme (PFSS) and the Safe Working Cycle (SWC) (Rowlinson, 2007). Accident rates have significantly decreased starting from the implementation of these schemes. However, the accident rate in the construction industry remains comparatively higher than that in other major industry sectors (Labour Department, 2013). Evaluating the effectiveness of existing safety measures is therefore necessary to ensure the downward trend of both the accident rate and the fatality rate. This study explores the effectiveness of the SWC in improving construction site safety performance in Hong Kong and determines key benefits, major difficulties and effective recommendations in executing the SWC. This paper will start with an extensive desktop review of the status of safety performance of the Hong Kong construction industry, different safety initiatives currently adopted in Hong Kong and the implementation mechanism of the SWC. Subsequently, the research methodology that involves face-to-face interviews will be outlined and then the research findings will be presented and discussed. The perceived benefits, potential difficulties and possible recommendations on the SWC will also be identified and discussed. By consolidating the experience-based opinions of the interviewees, valuable insights may be gathered to form recommendations for the smooth implementation of the SWC in the future. It is also expected that some valuable insights into the extended application of the SWC based on the lessons learned from new-build construction projects to facilities service management and massive building repair / maintenance could be generated from the research findings.

2. Safety performance of the construction industry in Hong Kong

The overview of the archival safety statistical records of the Hong Kong construction industry over the past decade (2000 to 2012) reflects the current situation and existing problems of the industry. The data contained therein justify the need for further discussion on the SWC that is currently being implemented in Hong Kong.

From 2000 to 2012, the accident rate in the construction industry decreased significantly from 149.8 per 1,000 workers in 2000 to 44.3 per 1,000 workers in 2012, as illustrated in Figure 1. The decrease in accident rate reflected the significance and the effectiveness of various safety measures or initiatives introduced in Hong Kong during the period. However, the number of construction site accidents in 2012 at 3,160 out of 12,547 industrial accidents, accounting for 25.2%, still poses a serious problem for the Hong Kong construction industry.

The accident rate in the construction industry is always twice the overall accident rate in major industries, as seen in the 2008 figures of 61.4 per 1,000 workers involved in construction accidents against 27.2 per 1,000 workers across all major industries. These figures verify that the construction industry is a high-risk and hazardous industry, which contributes to the hesitation of the youth to this sector.

As shown in Figure 2, the number of industrial fatalities in the construction industry was 24 in 2012, which was slightly higher by 4.3% in 2011 at 23 fatalities and much lower by 17.2% in 2000 at 29 fatalities. From the 29 total industrial fatalities in 2012, 24 (82.8%) were from the construction industry (Labour Department, 2013). This figure generated an enormous negative effect on the reputation and image of the construction industry.

In summary, although both the accident rate and the fatality rate in the construction industry have exhibited a downward trend over the past decade, the numbers remained relatively high compared with that of other industries and by international standards. This observation highlights the need to improve site safety performance further.

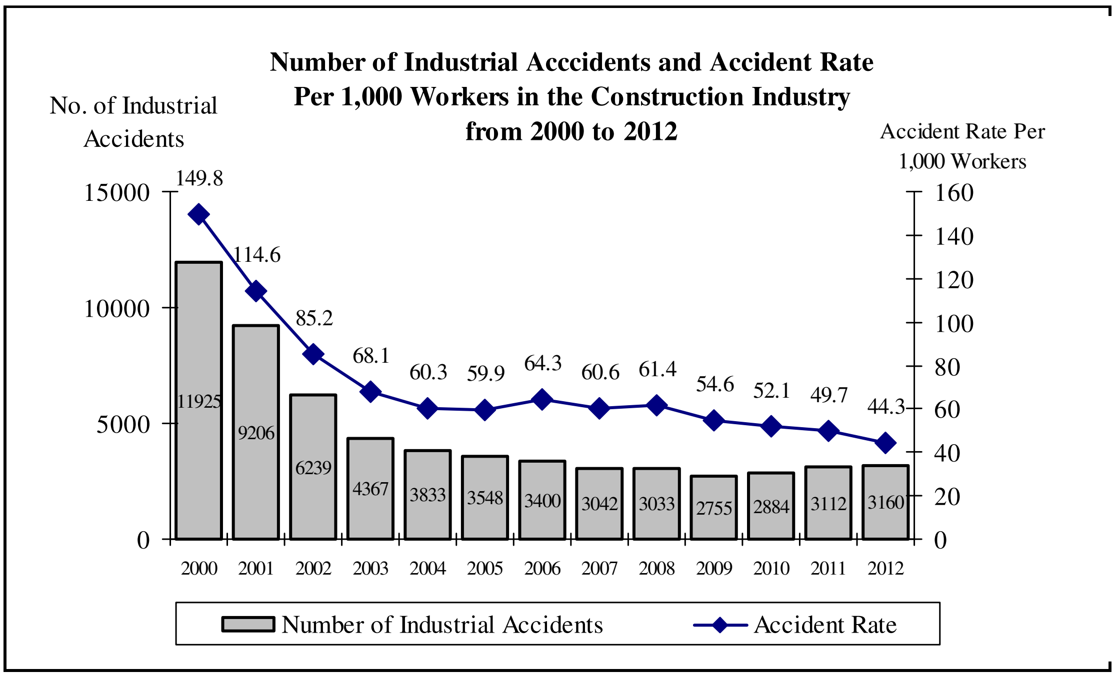

Figure 1. Number of industrial accidents and accident rate per 1,000 workers in the Hong Kong construction industry from 2000 to 2012 (Source: Labour Department, 2013).

3. Chronicles of construction safety initiatives in Hong Kong

In the light of the prevailing safety problems, different safety initiatives or measures in both public and private sectors have been introduced and implemented by the Government of the Hong Kong Special Administrative Region (HKSAR). Most of these safety initiatives or measures are mandatorily executed in public works contracts, but are voluntarily adopted in the private sector. The safety initiatives introduced between 1994 and 2005 include the Safety Management System (SMS), the Pay for Safety Scheme (PFSS), the Performance Assessment Scoring System (PASS) and the Safe Working Cycle (SWC) (Rowlinson, 2007). These safety measures are equipped with different implementation mechanisms established across various project types and scales.

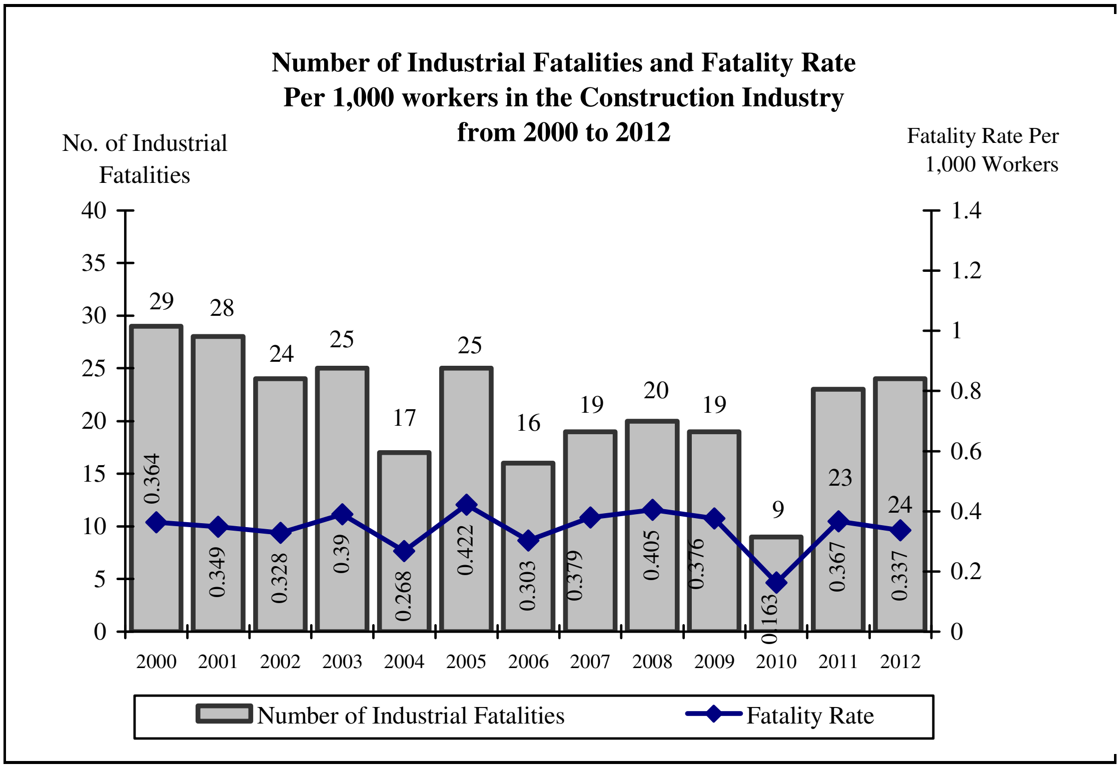

Figure 2. Number of industrial fatalities and the fatality rate per 1,000 workers in the Hong Kong construction industry from 2000 to 2012 (Source: Labour Department, 2013).

4. Application of safety incentive schemes in construction

Safety incentive schemes have been widely implemented in the construction industry and have long been recognised as a strong impetus towards improving company performance and motivating the workforce (Leichtling, 1997). Such schemes are one of the highly influential zero-accident techniques (Hinze and Wilson, 2000). Companies utilise different types of safety initiatives to enhance site safety of workers; the most widely implemented type of programme is those involving safety incentives (Hinze and Gambatese, 2003). Typically, safety incentive schemes offer tangible 'prizes' (e.g., bonus, gift, coupon, or certificate) to well-performing individual employees or contractors. Tangible rewards are regarded as powerful drivers of good safety performance (Austin et al., 1996), especially towards individual workers. Both LaBar (1997) and Laws (1996) concurred that safety incentive schemes are generally applied to mitigate workplace accidents, strengthen safety behaviours and improve safety-related records. Several organisations in the United Kingdom had established internal safety incentive schemes to promote the safety performance of workers (Krause, 1998). Based on the research by Gangwar and Goodrum (2005), the top three objectives of implementing a safety incentive programme include: (1) convincing workers to adopt safer work practices; (2) increasing safety awareness among workers; and (3) reducing recordable accidents. Many companies have introduced a safety incentive programme that is not only aimed to lower accident rates but also to influence safety behaviours and increase safety awareness of workers, thereby remarkably improving safety performance.

Table 1. Summary of the application of safety initiatives or measures in Hong Kong from 1994 to 2005 (Source: Rowlinson, 2007)

Year	Major construction safety initiatives or measures in Hong Kong
1994	Safety Management System (SMS)
1994	Pay for Safety Scheme (PFSS)
1994	Performance Assessment Scoring System (PASS)
1994	Safety Plan
1995	Consultation Paper on Self-Regulatory SMS
1996	Green Card Scheme: Mandatory Safety Training Programme
1997	Construction Sites (Safety) Regulations
1997	Factories and Industrial Undertakings Ordinance (Chapter 59)
1997	Occupational Safety and Health Ordinance (Chapter 509)
1998	Construction Site Safety Manual and Handbook
1998	Site Supervision Plan System
1998	Occupational Safety and Health Regulations
1999	Factories and Industrial Undertakings (Amendment) Ordinance
2000	PASS (revised to include PFSS provisions)
2000	Contractor Performance Index System
2000	Code of Practice for Site Safety Supervision
2001	Automatic Suspension from Tendering System
2002	Safe Working Cycle (SWC)
2002	Factories and Industrial Undertakings (Safety Management) Regulations
2002	Code of Practice on Safety Management
2003	Construction Sites (Safety) (Amendment) Regulations
2005	Safety Partnering Programme

Although the implementation of safety incentives may positively enhance site safety performance, some specific factors are extremely important to obtain satisfactory outcomes in developing effective safety incentive programmes. Previous researches, such as those of Stranks (2000), Rue and Byars (2001), Rowlinson (2003), Tam et al. (2004) and Abudayyeh et al. (2006), have identified key factors contributing to successful safety programmes, including worker involvement, management commitment, sufficient resource allocation and teamwork atmosphere. However, the multi-layered subcontracting system prevalently adopted in Hong Kong has become an impediment to safety (Rowlinson, 2007). The several layers of subcontracting downstream from a main contractor has heightened the potential for accidents (Debrah and Ofori, 2001), as observed in Singapore where, similar to Hong Kong, a chain of subcontractors reaches up to the third or fourth level in most construction projects. As the number of layers increase, the probability of having limited safety-related communications, coordination and control at site level increases (Debrah and Ofori, 2001; Rowlinson, 1997). A worst case is when main contractors shift all safety responsibilities to subcontractors and do not ensure whether the subcontractors are capable of providing a safe working environment or not (Wilson and Koehn, 2000). Implementing safety schemes can be difficult because of inadequate resources on site safety issues and the fact that the construction industry is often operated under a highly competitive environment (Banfield et al., 1996; Mayhew, 1997; Vassie et al., 2000).

5. Background of the SWC

The SWC, also called the Site Safety Cycle (SSC), was introduced to the Hong Kong construction industry in 2000; the concept of the SWC is originally from Japan, is similar to the 5S housekeeping management programme (organisation, orderliness, cleanliness, standardisation and discipline) and has been practiced for more than 20 years (Environment, Transport and Works Bureau, 2002). The SWC is a management tool used to overcome difficulties in different aspects of management systems. After implementing the SWC, the Japanese construction industry exhibited remarkable progress in safety and health, and the number of accidents decreased significantly (Occupational Safety and Health Council, 2002).

The SWC is a safety measure embodying a well-organised SMS, comprising the Daily Cycle, the Weekly Cycle and the Monthly Cycle (Li and Poon, 2007). The aim of the SWC is to ensure a tidy worksite and to promote safety awareness among construction workers by performing daily repetitive procedures that later form safety habits (Occupational Safety and Health Council, 2006). The SWC focuses on the causes of construction accidents and improves the overall safety performance of construction sites.

The SWC was adopted under the PFSS in six designated contracts for trial run. After two years of trial run, the SWC was formally launched and has been widely applied in Hong Kong under PFSS since 15 August 2002, particularly to all public works projects (PWP) and capital works contracts that include design-and-build contracts (Environment, Transport and Works Bureau, 2002; Highways Department, 2002).

6. Goals of the SWC

The SWC implementation can enhance communication of safety and health concerns between the site safety managers or supervisors and the frontline workers. It helps promote safety awareness among construction workers by introducing a preventive approach and ensuring safe site conditions (i.e., good housekeeping and tidy worksite). By achieving its underlying objectives, the SWC can improve site safety performance and prevent the occurrence of site accidents (Environment, Transport and Works Bureau, 2002).

The SWC implementation aims at cultivating safety habits among all project team members, especially the frontline workers. It assists in developing an effective safety culture at construction sites and in fostering safe work behaviours of frontline workers by the conduct of daily repetitive procedures (Ozaka, 2000).

7. Operational mechanism of the SWC

Three different cycles and 15 essential items comprise the SWC. The three cycles are the Daily Cycle, the Weekly Cycle and the Monthly Cycle. The operational mechanism of each cycle is described and summarised in Table 2.

7.1 'Daily' SWC

The Daily Cycle comprises eight essential items scheduled according to the project schedule and can be presented in a time chart. Every person involved must perform his/her responsibilities based on the project schedule. Each organisation must regulate the working hours for each item by considering the characteristics of the project (Occupational Safety and Health Council, 2006).

7.2 'Weekly' SWC

The Weekly Cycle provides an overview of the safety performance during the past week, identifies prevailing problems and facilitates the improvement of existing safety measures for the succeeding week and the near future. The Weekly Cycle has three primary steps: weekly inspection and check-up, process safety discussion and weekly tidying up (Occupational Safety and Health Council, 2006).

7.3 'Monthly' SWC

The Monthly Cycle aims to review the most recent site safety performance and the monthly progress of work. Safety training activities can enhance safety awareness of the frontline workers. The promotional campaign is launched to provide proper recognition of sustained efforts of individuals in maintaining and upgrading the current site safety performance (Occupational Safety and Health Council, 2006).

Table 2. Summary of the essential items in the Safe Working Cycle
(Source: Occupational Safety and Health Council, 2006)

No.	Items	Participants
'Daily' Safe Working Cycle		
1	Morning safety briefing meeting (i.e. pre-work physical exercise plus common safety hazards and precautions for 15 minutes, e.g. working at height)	All workers
2	Hazard identification activity (HIA) meeting for another 10 minutes (e.g. trade-based electrical services - welding, cutting, etc)	All work teams
3	Prior-to-work inspection	Engineers, competent persons, plant operators, etc
4	Safety inspection	Project managers, site agents, etc
5	Guidance and supervision at work	Team representatives, foremen, etc
6	Process safety discussion	Project managers, site agents, foremen, etc
7	Tidying up after work	All workers
8	Final check after work	Team representatives, foremen, etc
'Weekly' Safe Working Cycle		
1	Weekly safety inspections and weekly check-up	Inspections: Project managers, site agents, etc Check-up: Engineers, competent persons, plant operators, etc
2	Weekly process safety discussion	Project managers / site agents, safety officers, subcontractor representatives, etc
3	Weekly tidying up	All workers
'Monthly' Safe Working Cycle		
1	Monthly inspection	Engineers, competent persons of main contractor and subcontractors
2	Monthly safety training	Safety officers and all workers
3	Monthly safety meeting	All workers
4	Safety committee meeting	Members of the safety committee

8. Research methodology

A combination of two data collection methods (i.e., archival desktop study and in-depth interviews) was applied to achieve the stated objectives of this research. A comprehensive desktop review of extant related literature was first undertaken, involving various sources such as academic journals, conference proceedings, reference textbooks, previous dissertations and online materials on the SWC and its applications in Hong Kong and worldwide.

With the aim of investigating the effectiveness of the SWC in accident prevention and mitigation in Hong Kong, a series of face-to-face in-depth interviews were launched to solicit the knowledge and opinions of different senior project or safety practitioners in both the public and the private sectors. The selected target organisations comprised relevant government departments and the main contractors. The target interviewees included project managers, safety managers or officers and site engineers who had direct hands-on experiences in the SWC. Experienced and knowledgeable persons involved in construction projects can provide valuable feedback and insightful comments on the effectiveness of the SWC, the associated benefits and difficulties during implementation, and recommendations for improvement of the SWC in the future.

9. Analysis of interview dialogues

The professional views on the effectiveness of implementing the SWC were gleaned by 10 in-depth interviews involving the representatives of senior professional staff members from major construction companies and related government departments, as listed in Table 3. A number of previous research studies (e.g. Chan et al., 2011a; Chan et al., 2011b; Choudhry and Fang, 2008; Hatush and Skitmore, 1997) had adopted the same research technique, with five to seven interviewees who were perceived to sufficiently represent the respective populations under study. The ten interviewees in the present study represented senior project or safety practitioners working for relevant government departments (Interviewees C, E, I and J) and leading local and international construction contractors (Interviewees A, B, D, F, G and H) with abundant hands-on experiences in the SWC projects in the construction sector. Thus, the interview results and feedback were considered representative and reliable in substantially covering the entire population under investigation.

Theoretical saturation of data is a term in qualitative research, mostly adopted in the grounded theory approach. Data saturation is an important tool of evaluating qualitative data (Kerr et al., 2010). In recent years, data saturation has become the gold standard by which purposive sample sizes are determined in qualitative health science research (Guest et al., 2006). Theoretical saturation of data means that researchers reach a point in their analysis of data that sampling more data will not lead to more information related to their research questions (Seale, 1999). Theoretical saturation is achieved when subsequent interviewees do not identify any new additional factors. Researchers see in their data similar instances over and over again and that make them empirically confident that their categories are saturated, and they are allowed to stop sampling data and to round off their analysis. Morse (1994) and Creswell (1998) advocated the minimum sample size in qualitative research to be at least 5-6 interviews to meet the target of data saturation. Since all of the major perceived benefits and potential difficulties of the SWC have been voiced out by the ten experienced interviewees with some consensus and sufficient repetitions amongst them, data saturation has been achieved in this qualitative research study.

The interview questions were grouped into two main sections. The interview questions under Section A intended to obtain background information about the interviewees, the length of construction experience, type of working organisation, project type in implementing the SWC and level of hands-on experience in managing the SWC projects. The interview questions in Section B gathered their professional perceptions and opinions on the effectiveness of the SWC in improving site safety performance. Moreover, the perceived benefits and potential difficulties of the SWC and the recommendations of the interviewees in overcoming encountered difficulties and in improving the SWC measures for the successful implementation in the future were also sought and discussed. The interviewees were encouraged to express their views without restraint on the issues under scrutiny.

The scope of the investigation, which is covered by the interviews, can be summarised into three main areas as follows:
1. Effectiveness of the SWC in avoiding and reducing site accidents
2. Perceived benefits and potential difficulties in the implementation of the SWC
3. Recommendations or measures for the successful implementation of the SWC in the future

Table 3. Summary of the personal profiles of the interviewees

Interviewee	Position	Organisation	Years of working experience	Number of the SWC projects involved
A	Senior Safety Officer	Hip Hing Construction Company Limited	16 to 20 years	10 or more
B	Project Safety Manager	Leighton Contractors (Asia) Limited	11 to 15 years	7 to 9
C	Senior Engineer	Architectural Services Department	> 20 years	10 or more
D	Project Manager	Hsin Chong Construction Group Limited	16 to 20 years	4 to 6
E	Senior Manager (Safety and Health)	Housing Department	> 20 years	10 or more
F	Safety Manager	Laing O'Rourke-Hsin Chong-Paul Y Joint Venture	16 to 20 years	10 or more
G	Senior Safety Officer	Chun Wo Construction and Engineering Company Limited	> 20 years	4 to 6
H	Senior Engineer	Gammon Construction Limited	> 20 years	10 or more
I	Clerk of Works	Housing Department	16 to 20 years	7 to 9
J	Project Safety Manager	Mass Transit Railway Corporation	> 20 years	7 to 9

The SWC has emerged as a common practice in different sectors and various projects in the Hong Kong construction industry since August 2002 (Rowlinson, 2007). The interviewees were engaged in either the public sector or the private sector of the construction industry for more than ten years and have participated in over four civil engineering or building projects with the SWC in place.

Considering that all the interviewees were well-experienced professionals in the construction sector, their opinions gathered during the in-depth interviews were considered reliable and representative, and reflected the true perceptions of the SWC practices in the construction industry.

The interviews were recorded and transcribed, and then were sent by email to the corresponding interviewees for verification and confirmation. The fundamental concepts of the interview dialogues were duly analysed by content analysis that utilised a matrix table to capture any similarities and differences for cross-comparisons. Content analysis is a useful technique of data analysis that has been employed in several construction management studies (Fellows and Liu, 2008). Content analysis classifies textual materials, reduces the contents to relevant and manageable bits of data (Weber, 1990) and then obtains information and understanding of issues relevant to the general aims and specific questions of a research project (Gillham, 2000; Chan et al., 2011a). This method can help in determining the collective opinions of different industrial practitioners on the application of the SWC in a specific area.

10. Perceived benefits of implementing the SWC

With respect to the responses of the 10 interviewees, the key benefits of the SWC are summarised in Table 4. Nine different perceived benefits of the SWC were identified by 10 interviewees and classified into two main categories: subsidiary and principal benefits. Subsidiary benefits comprise benefits obtained by on-site management staff members and the frontline workers, better understanding of site conditions and daily operations, enhanced safety awareness, establishment of safety habits and dissemination of safety-related communications. Operating the ‘Daily’, ‘Weekly’ and ‘Monthly’ SWC may largely enhance safety awareness of frontline workers and management staff members as a result of participation in some of the items in the SWC, such as morning safety briefing, hazard identification activity (HIA), process safety discussion and safety training, which significantly enrich their site safety knowledge and establish proper safety habits. With the victims of site accidents mostly frontline workers, the reinforcement of safety awareness and the cultivation of safety habits will be the most suitable and most effective in preventing construction accidents (Chan et al., 2005; Chan et al., 2010).

The second category is principal benefits that comprise benefits in direct relation to the overall site safety performance, such as the prevention of site accidents and improvement of site safety standards. These benefits can directly reflect the effectiveness of the SWC implementation in increasing site safety performance. In addition, these benefits are supported by subsidiary benefits of the SWC, which are classified as the first category.

Most of the interviewees generally believed that the implementation of the SWC has mainly reduced the accident rate in the construction industry in recent years, as observed by Chau and Lee (2007). Interviewees A and E strongly agreed that the SWC is a successful and effective safety measure in promoting site safety performance, as proven by the small number of site accidents in both the public and private sectors over the past decade. While the improvement may not be solely attributed to the execution of the SWC, it was considered as one of the key drivers for improvement. Therefore, the overall safety performance of public works contracts has been continuously enhanced over the years (Rowlinson, 2007).

Table 4. Key perceived benefits of the SWC implementation

Perceived benefits of the SWC implementation	**Interviewee**										**Total number of hits for each benefit identified**
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	
1. Enable better understanding of site conditions and daily operations	✔			✔				✔	✔		**4**
2. Facilitate safety-related communications between site management staff members and frontline workers	✔		✔	✔	✔	✔	✔		✔	✔	**8**
3. Enhance safety awareness of frontline workers	✔	✔	✔		✔	✔	✔	✔	✔		**8**
4. Prevent the occurrence of construction accidents	✔	✔	✔	✔	✔	✔	✔	✔		✔	**9**
5. Establish safety habits of frontline workers	✔		✔		✔	✔		✔	✔		**6**
6. Improve site safety performance and housekeeping			✔			✔				✔	**3**
7. Eliminate compensation costs incurred by accidents.				✔		✔				✔	**3**
8. Promote company reputation and image regarding having better site safety				✔		✔		✔		✔	**4**
9. Identify potential hazards	✔	✔		✔	✔	✔	✔		✔	✔	**8**
Total number of benefits identified by each interviewee	**6**	**3**	**5**	**6**	**5**	**8**	**4**	**5**	**5**	**6**	**53**

Interviewees A and D emphasised that safety briefings facilitated a working procedure based specifically on site conditions, thereby minimising the occurrence of construction accidents. Interviewees C and F further expressed that the accident rate was reduced by increased compliance with the promulgated safety and health regulations and rules. Interviewee H believed that the SWC is an ideal system that reminds and reviews essential safety precautionary measures for all construction workers and site supervisory staff members.

'Enhance safety awareness of frontline workers' was considered one of the most significant benefits of the SWC. Interviewees A, B, C, E, F, G, H and I unanimously agreed that the SWC could promote safety awareness of both site management personnel and construction workers, as advocated by Tse (2005) and Chan et al. (2010). Interviewee H opined that the SWC implementation could increase safety awareness at the frontline level and foster good safety culture at the management level. Wong et al. (1996) revealed that by attending safety training, workers also intensified their safety awareness in addition to enhancing their safety knowledge. Thus, 'enhance safety awareness of frontline workers' was identified as the second most important benefit that may possibly be due to the positive outcome of safety training in the 'Monthly' SWC. Fung et al. (2005) indicated that workers are generally indifferent and passive on safety issues and have poor safety attitudes. Furthermore, most workers are less educated compared with management teams and supervisory staff members, thus they always ignore the importance of construction safety.

When a project adopts the SWC, sufficient safety training is necessarily provided to workers. These programmes on safety training are useful in educating workers on the importance of site safety, their legal rights and duties on site safety issues and in increasing their safety awareness (Chan et al., 2005; Fung et al., 2005). Interviewees A, C, E, F, H and I further advocated that the successful implementation of the SWC would encourage safety habits among frontline workers, thereby improving site safety and tidiness that can reduce potential accidents. Chau and Lee (2007) also pointed out that launching activities, such as safety committee meetings, safety inspections and safety discussions between site agents, foremen and workers, will not only increase safety awareness but also improve housekeeping and site tidiness.

Effective communications of safety-related information between different contracting parties is an essential element in establishing proper site safety management (Koys and De Cotiis, 1991; Cheyne et al., 1998; Hoffmann and Stetzer, 1998; Wong et al., 2004). All interviewees except for B and H found that the unique cyclic feature of the SWC facilitates the generation of positive outcomes in different site meetings by site management staff members and construction workers. Both Interviewees A and C expressed that the implementation of the SWC may enhance the two-way communications between site workers and site management on the improvement of site safety. Interviewee H further cited that the SWC ensures regular communications with frontline staff members at the management level. Interviewee C advocated that the SWC's unique cyclic feature allows efficient dissemination of site safety information, both general and job-specific, to site workers on a daily basis. Tam and Fung (1998) revealed that the establishment of site safety committees could reduce accident rates. Safety committee meetings where safety-related information is conveyed and discussed facilitate an open and transparent exchange among management staff members on site safety issues involving the project team. The process also encourages increased two-way communications between site management and frontline workers on general improvement measures for site safety.

The perception of 'identify potential hazards' as another major benefit of the SWC is not surprising. Eight interviewees, namely, A, B, D, E, F, G, J and I mentioned that a number of potential hazards could be identified and handled during daily operations via the SWC. The working environment of the construction industry is fraught with hazards and is highly complex. Safety issues have always been a key problem because of poor site conditions and the need for co-ordination among different interdependent trades and operations (Laukkanen, 1999; Teo and Phang, 2005). HIA and morning safety briefings enable frontline workers to recognise potential hazards arising from their daily work and operations before any work commences. Interviewee D found that safety meetings allow safer work procedures to be planned based on specific site conditions, thereby minimising the occurrence of construction accidents. Interviewee B agreed that potential hazards for workers could emerge before the commencement of any work. Pre-work exercise also allows for both physical and mental warm-up for frontline workers.

11. Potential difficulties in executing the SWC

The execution of any safety incentive has potential positive outcomes. However, some difficulties may be encountered during the implementation of safety incentives. Kheni (2008) reported that a large proportion of his survey respondents experienced difficulties that hindered the effectiveness of safety schemes. These problems or difficulties may adversely affect the application of good safety schemes. Krause and Hodson (1998) observed that the value of safety incentive schemes has been debated for a long time. Evidence as to whether these incentives are effective safety management tools is ambiguous. Krause (1998) opined that the success of safety incentives depend on the appropriateness of a selected scheme for a particular situation.

The major difficulties encountered with the SWC, which were gathered from the responses of the 10 interviewees, are listed in Table 5.

Almost all interviewees (A, C, D, E, F, G, H and J) generally concurred that the lack of site space is a significant barrier to the implementation of the SWC because a huge open space is necessary to accommodate all site staff members and construction workers in the conduct of morning briefing activities and pre-work physical exercise. Interviewee A pointed out that the space where all workers are gathered for morning safety briefings, morning physical exercise, or hazard identification at the work site is insufficient. Limited space is a common problem in Hong Kong, which could directly hinder the proper implementation of the SWC. This issue was similarly investigated by Li and Poon (2007). Interviewee C opined that with the simplicity and straightforwardness of the SWC, no major difficulties or constraints would be encountered in its application, except at small construction sites where adequate open spaces are lacking for the launch of morning physical exercise or safety briefing activities in the Daily Cycle.

Table 5. Major potential difficulties encountered in the SWC implementation

Potential difficulties in the SWC implementation	**Interviewee**										**Total number of hits for each difficulty identified**
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	
1. Limited site space for carrying out necessary morning physical exercise or activities	✔		✔	✔	✔	✔	✔	✔		✔	**8**
2. Irregular working schedules of workers from different trades at various stages of projects	✔			✔	✔	✔			✔	✔	**6**
3. Resistance from subcontractors and workers to participate in the SWC if the training venue is far from their workplace	✔	✔		✔		✔	✔	✔			**6**
4. Over-tight project schedule resulting in rush jobs (e.g., four-day floor cycle of high-rise buildings)	✔			✔	✔	✔		✔		✔	**6**
5. Lack of motivation among workers to participate in the SWC (e.g., regular daily event is considered as time consuming or boring)		✔		✔	✔	✔	✔	✔	✔		**7**
6. Insufficient financial support to cover the necessary SWC items set as unit rate in contracts under the Pay-For-Safety Scheme (PFSS)			✔	✔		✔		✔	✔	✔	**6**
7. Inadequate education or promotions from the government (e.g., poor worker's mentality)				✔		✔	✔				**3**
Total number of difficulties identified by each interviewee	**4**	**2**	**2**	**7**	**4**	**7**	**4**	**5**	**3**	**4**	**42**

Chan and Kumarawamy (1996) explained that a project is regarded as successful if it is completed on schedule, within target budget and to the level of quality standards specified by the client organisation. An over-tight construction schedule significantly hinders the implementation of construction site safety in Hong Kong (Mohamed, 2002). Speed of production is always prioritised more than safety, which could lead to a major safety concern (Proverbs et al., 1996). A job behind schedule can create an atmosphere of tension, forcing people to work faster than normal, compromising safety in the process (Tam and Fung, 2011). Therefore, an over-tight project schedule may pose an enormous difficulty to contractors in launching the SWC because of rush jobs. Interviewees A, D, E, F, H and J also concurred that time is another constraint in executing the SWC in the construction industry because of the tight work schedule being followed to complete the projects, thus requiring work to be performed as fast as possible to timely handover the site back to the client and avoid paying for potential liquidated damages arising from unexpected delays (Chan and Kumaraswamy, 2002). As a result, some of the essential items under the SWC may be abandoned to save time, including morning safety briefings, safety discussions, safety inspections and enforcement of site cleanliness.

Interviewees A and D expressed that some subcontractors and frontline workers do not comply with the stipulated items under the SWC. As mentioned by Interviewee A, several subcontractors resisted attending morning safety briefings. Interviewee H observed that workers of subcontractors are usually uncooperative in performing the stipulated the SWC items. Multi-layered subcontracting system is very common in the Hong Kong construction industry. Subcontractors generally constitute a large portion of the workforce for different trades of work in a typical construction project. Thus, subcontractors play an important role in upholding site safety, as revealed by earlier studies (Debrah and Ofori, 2001; Rowlinson, 1997; Hislop, 1999). Subcontractors and their employed workers, being the frontline operators on-site, are the ones with the highest liability for site safety (Toole, 2002; Langford et al., 2000; Love, 1997). The absence of any labour parties during safety briefings may weaken the effectiveness and execution of the SWC because these meetings provide a direct communication platform for safety-related issues involving site management staff members and construction workers, and the participation of both parties is essential to the success of the SWC.

In most cases, the communications among client organisation, main contractor and various layers of subcontractors are unclear and inefficient, thus consequently hindering the effective execution of the SWC. Low-tier subcontractors may not be fully aware of the stipulated safety requirements of the client or any safety measures agreement, leading to adverse safety performance and ineffective implementation of safety measures (Wong et al., 2004; Yik et al., 2007). Six interviewees (A, D, E, F, I and J) also stated that gathering various trades of workers during morning safety meetings is difficult because their work schedules are generally different and are relative to the type of trade and work progress or because they enter the site through various entrances. This non-compliance is contributed by human-related factors (Tang et al., 2003) and is one of the major causes of construction accidents.

Seven interviewees stated that the lack of motivation of workers to participate in the SWC (e.g., a regular daily event is considered time-consuming or boring) is one of the most significant difficulties in implementing the SWC. Interviewees B and D opined that several workers regarded pre-work meetings and physical exercise as boring, thus they lack the eagerness to participate in key activities under the SWC. Interviewee D specifically mentioned that the government has not allocated adequate inputs in the conduct of the SWC in terms of education, promotions and financial support. If the financial strength of an organisation undertaking construction work is considerably weak, various resources and facilities that are necessary to implement a safe construction process are not always readily available (Mayhew, 1997; Vassie et al., 2000). Thus, the provision of safety incentives will be difficult for small-sized subcontractors.

Interviewees C, D, F, H, J and I perceived insufficient financial support to cover the necessary SWC items under the PFSS in construction contracts as another profound barrier to the execution of the SWC. Ahassan (2001) indicated that the lack of adequate resources on site safety matters primarily leads to the unsuccessful implementation of safety incentive programmes. Kheni (2008) expressed that the benefits acquired from an effective safety incentive scheme cannot be provided without investing in health and safety issues. Thus, sufficient financial support is crucial to the success of any safety programme for operation such as the SWC.

12. Recommended strategies or measures for the successful implementation of the SWC

Several useful and practical recommendations for future implementation of the SWC were mentioned by the interviewees. The majority of building and civil engineering projects in Hong Kong are usually subcontracted. Previous studies had observed that trade subcontractors and their workers exhibit less positive attitude towards site safety than main contractors and their workers (Occupational Safety and Health Council, 2003; Chan et al., 2005). The highly subcontracted structure of the construction industry can contribute to poor safety performance. Therefore, to improve construction site safety further, more resources should be provided and wider attention should be given to enhance safety awareness and inculcate a safety culture among the workers of subcontractors.

All the interviewees recommended the establishment of a safety promotion or reward scheme (e.g. cash reward, bakery coupon, certificate of appreciation, best safety model worker award and best SWC site award) to encourage subcontractors and their workers to participate in the SWC , as previously suggested by Li and Poon (2007) and Choi et al. (2012). This reward or promotion scheme can motivate most workers and will be effective in encouraging workers to work safely. Another insightful suggestion by Interviewees A, B and F is the engagement of professional aerobic trainers to lead the pre-work physical exercise that will inject innovative elements into the SWC and render the SWC-related activities as less boring, especially if they are regular daily events. Interviewees C and D suggested that more financial support from client organisations in both the public and private sectors should be obtained to carry out the requisites of the SWC. Six interviewees (C, D, E, H, J and I) opined that a mandatory enforcement of the SWC for all new construction projects, whether private or public, through legislation is a most effective strategy. At present, the implementation of the SWC is mandatory in almost all public sector projects, whereas that in the private sector remains on a voluntary basis. Therefore, the private sector has the flexibility of not adopting the SWC. The safety performance of private sector projects would be significantly enhanced if the SWC is compulsorily enforced through legislation.

Interviewees A, B and F suggested that improvements to the effectiveness of the SWC in achieving better site safety performance could be realised by providing for a regular review of the SWC execution during weekly or monthly site safety committee meetings that involve senior management staff members. Site safety performance and the implementation of the SWC in a particular week or month can be presented and reviewed, followed by open discussions among managerial staff members, foremen and frontline workers on-site. Improvement strategies or effective measures can also be generated and converted into new policies or schemes for trial run under a collaborative atmosphere.

Another recommendation by Interviewees A, C and J is a tailor-made daily cycle of the SWC for a specific site, according to the different site activities and conditions. This arrangement can better facilitate the smooth implementation of the SWC at site level. The project schedule for work at the early stages should be designed to accommodate the necessary activities under the SWC. This would prevent the rushed jobs that result in sacrificing SWC activities (Choi et al., 2012).

More importantly, Interviewees D and E emphasised that education can contribute to further improvements to site safety. With reference to cases in Japan and other developed countries, Interviewee E explained that education is important and indispensable in building a strong on-site safety culture. The principle behind the SWC is to develop proper safety culture at site level (Ozaka, 2000). Generally, however, the mentality of construction workers is poor and varies from one person to another. While good safety culture cannot be cultivated within a short time period, the education of frontline workers must be continuous (Chan et al., 2010; Hon et al., 2011). Once proper safety culture is created, a tidier and safer worksite can be secured. Appropriate regular training programmes should also be provided for frontline safety officers or supervisors to launch the SWC more successfully and persistently.

13. Conclusions

The SWC has been widely adopted in various public sector projects, such as civil engineering and building projects, as well as in some private sector building projects. This study has provided an overview of the current application of the SWC in Hong Kong and has identified underlying benefits, major difficulties and useful recommendations on the SWC by a series of in-depth interviews with several senior project or safety practitioners.

The SWC is one of the safety initiatives that has contributed to the decline of construction accidents and fatalities in Hong Kong, therefore proving that the SWC is successful and effective in improving site safety performance. All interviewees observed that the most significant benefit of the SWC is its prevention and mitigation of construction accidents. Other perceived benefits include the facilitation of safety-related communications, promotion of safety awareness, identification of potential hazards and cultivation of safety habits. Limited site space, irregular work schedules of various workers, a lack of motivation for participation and an over-tight project schedule are revealed as primary barriers to the execution of the SWC at site level.

Several improvement strategies were recommended to enhance the implementation of the SWC in the future. These recommendations include the establishment of a reward scheme, engagement of professional aerobic trainers, design of site-specific SWC, mandatory enforcement of the SWC through legislation, regular review of the SWC effectiveness, increased financial support from client organisations, and creation of a more realistic project schedule. The synthesis of the different opinions on the above attributes of the SWC between clients and contractors will enable project team members to maximise the perceived benefits and minimise potential difficulties in adopting the SWC.

A wider debate has been triggered in this paper on the underlying benefits and potential difficulties of the SWC for reference by the construction industry at large. Although the SWC has been widely executed in public sector projects, more projects adopting the SWC should also be launched in the private sector to explore its effectiveness and provide a basis for comparison on the implementation of the SWC between the public sector and the private sector. On the other hand, it is advocated that the SWC can be extended to cover the broad sector of facilities service management and large-scale building maintenance / renovation in both Hong Kong and overseas as well.

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